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L. C. Hanson Company
Shadwell Creek Fire Project, MT A/E 86-46-113, Richland County, Montana

FINAL REPORT

SHADWELL CREEK FIRE PROJECT
MT A/E 86-46-113
RICHLAND COUNTY, MONTANA

January, 1988

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FINAL REPORT

SHADWELL CREEK FIRE PROJECT
MT A/E 86-46-113
RICHLAND COUNTY, MONTANA

January, 1988

Prepared for:

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L. C. HANSON COMPANY
CONSULTING ENGINEERS & SURVEYORS
HELENA — GREAT FALLS — GLENDIVE

FINAL REPORT

SHADWELL CREEK FIRE PROJECT

I. INTRODUCTION

A. PROJECT OBJECTIVES

The project goal was to construct a soil-cement and earthen embankment seal along the riverbank to stabilize the bank and cut off oxygen to the burning coal seams.

B. PROJECT LOCATION

The SHADWELL CREEK FIRE project is located on the east side of the Yellowstone River just north of the Shadwell Creek outlet to the river. The site is in Richland County, MT and situated in Sections 6 and 7, T20N, R59E.

C. HISTORY

Various families living in the Shadwell Creek area mined the site in 1938, 1939, and 1940. This was not a commercial operation but more a pick and shovel operation with families coming down the ice and digging it out of the riverbank as they needed it.

Previous work on putting out th fire has been attempted on the site by the BLM in the 1950's and by a research team from the University of Rollo, Missouri in 1985.

D. SITE DESCRIPTION AND PROBLEMS

The site is along the east bank of the Yellowstone River. The bank was continually eroding and could not support vegetation. A field above the bank is used by the local landowners for winter feeding and grazing of livestock. A rough road existed from the field to the Yellowstone River where a pump was used for irrigation.

Two coal seams located in the east bank of the river, extending approximately 2100 feet, were burning out of control. The coal seam fire had been burning unattended for several years, causing air pollution in the area. As the fire progressed through the coal seams, overburden positioned above the burned coal seams dropped into the river. The fire had reached a point where it could start surface fires, endanger residences and agricultural properties close to the site.

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II. DESCRIPTION OF RECLAMATION PROJECT

A. PROJECT PLANNING

Administration and Funding - Funding for the reclamation, planning and administration of the SHADWELL CREEK FIRE Reclamation Project was provided through a grant from the United States Department of the Interior, Office of Surface Mining. The Montana Department of State Lands' Abandoned Mine Reclamation Bureau administered the grant. L.C. Hanson Company prepared the reclamation plan and also administered the construction Contract, performed on-site inspection of construction and acted as the Department of State Lands' on-site representative.

Planning for the project was based on site visits, aerial photography and borehole drilling. The borehole drilling was completed in March and April of 1985. The results of the temperature monitoring were used to define the limits of the subsurface coal fire and design of the surface seal.

The project plan was to stabilize the riverbank with soil-cement embankment and build a soil seal to cut off oxygen to the coal fire. Soil cement was used because of the close proximity of a good gravel source and a more cost-effective method of bank stabilization compared to riprap.

Construction of a temporary dike was necessary to allow placement of the soil-cement below the surface of the water during daily river fluctuations. After construction of the soil-cement and earthen seal embankments, all disturbed areas were topsoiled and revegetated.

A permit from the Department of the Army, Corps of Engineers was applied for on January 14, 1986 and Permit No. MT 2SB OXT 3 008122 approved on June 16, 1986. A meeting with the Montana Department of Fish, Wildlife and Parks on February 3, 1986 defined design parameters for the construction of the temporary dike.

The final engineering was completed, bid documents and Contract fully assembled in June of 1986.

B. PROJECT SCOPE

The reclamation for the SHADWELL CREEK FIRE PROJECT included: salvaging and replacing topsoil, construction of a temporary dike, excavation and embankment, soil-cement embankment, borehole drilling and backfilling, irrigation ramp and pump pad, and fertilizing, seeding and mulching all disturbed areas.

C. THE RECLAMATION PLAN

The major work items included in this Contract were as follows:

Salvage and Replace Topsoil - Stripping and stockpiling, for future replacement, all topsoil from all areas to be disturbed.

Construct Temporary Dike - Constructing, maintaining and removing a temporary dike to enable construction of the soil-cement embankment.

Excavation and Embankment - Excavate, haul, stockpile and placement of material to flatten slopes and provide fill material.

Soil-Cement Embankment - Constructing a soil-cement embankment along the bank of the Yellowstone River to provide protection from wind, water and ice erosion and stabilize the bank.

Borehole Drilling and Backfilling - The drilling of more boreholes to install temperature probes for monitoring the subsurface coal fire.

Irrigation Ramp and Pump Pad - Construction of a road from the access road to the irrigation pump pad along the surface seal, including a gabion and concrete pump pad with 12' irrigation pipe.

Revegetation - Fertilizing, seeding and mulching of all areas disturbed by the reclamation work.

D. CONSTRUCTION PHASE

Schedule of Events - The following delineation of events tracks the construction phase of the project from bidding to final completion.

August 11, 1986 - The Montana Department of Administration issues an Invitation for Bids.

August 26, 1986 - L.C. Hanson Company conducts a Pre-Bid Conference at the site and representatives from 10 construction firms are in attendance.

September 9, 1986 - The Department of Administration opens 4 bids received.

September 12, 1986 - Montgomery Construction of Hilger, MT

is awarded the Contract as the successful low bidder.

October 1, 1986 - Construction commences on the SHADWELL CREEK FIRE PROJECT.

October 3, 1986 - The Notice to Proceed is issued.

November 19, 1986 - Payment Request No. 1 is approved.

November 26, 1986 - Change Order No. 1 is completed.

November 26, 1986 - The project is shut down for the winter.

December 11, 1986 - Payment Request No. 2 is approved.

April 13, 1987 - Resume Work Order is issued.

April 20, 1987 - Construction resumes on the SHADWELL CREEK FIRE PROJECT.

May 11, 1987 - Begin placement of soil-cement.

May 28, 1987 - Payment Request No. 3 is approved.

June 23, 1987 - Finish placement of soil-cement.

July 10, 1987 - Change Order No. 2 is approved.

July 10, 1987 - Temporary Shut Down is approved.

August 4, 1987 - The Corps of Engineers is requested to modify the permit to allow the remaining sections of the temporary dike to remain in place and construction of the pump pad.

August 6, 1987 - Payment Request No. 5 is approved.

October 9, 1987 - The Corps of Engineers approves the request to allow the remaining sections of the temporary dike to remain and the construction of the pump pad.

October 27, 1987 - Resume Work on the SHADWELL CREEK FIRE PROJECT. Revegetation work begins.

November 11, 1987 - Begin construction of the irrigation pump pad.

November 11, 1987 - Canyon Creek Maintenance project is completed.

November 18, 1987 - Irrigation pump pad is completed.

November 19, 1987 - Reclamation work is completed on SHADWELL CREEK FIRE SITE.

E. EQUIPMENT USED

The salvaging and replacing of topsoil, construction of the temporary dike and excavation and embankment were performed with the following equipment:

Terex TS-18B Scraper - twin-engine

Caterpillar D-7 Dozer (2)

Caterpillar CAT-21 Scraper - single-engine

P & H 418 1-1/4 Yd Tractor-mounted Backhoe

John Deere 690 Tractor-mounted Backhoe

John Deere 310 Rubber-tired Backhoe

1 Ford Tandem and 3 GMC Dump Trucks - 10 C.Y. each

Bomag Vibratory Smooth-drum Roller

8,000 Gallon Water Truck

1-Ton Tandem Mechanics Truck

1-Ton Fuel Truck

Mixing and placing of the soil-cement were completed with the following equipment:

Caterpillar 966 Front-end Loader w/4.0 C.Y. bucket

Kohlman Screen Plant w/2" screen

Small Hopper w/Conveyor belt

Cement Scale and Conveyor belt

Aggregate Scale anda Conveyor belt

20-foot Cylinder Mixer (trammel)

100-foot Conveyor Belt

2000 Gallon Water Tank w/pump

Cement truck 10-ton capacity

Two (2) Cement Trucks used for Storage - 20-ton capacity

28-foot Trailer w/GMC power plant

F. WORK DESCRIPTION

Montgomery Construction mobilized equipment to the SHADWELL CREEK FIRE site in October, 1986 and began topsoil stripping and stockpiling. Ken Burnham was the foreman for the project for Montgomery Construction. Topsoil was removed from the waste area, borrow area, and from areas within the excavation limits. A majority of the topsoil came from the waste area and borrow area where the depth of the topsoil was consistently over 6 inches. The topsoil was placed in two separate piles that, at the time of winter shut down, were protected from wind erosion by the application of 4000 pounds per acre of vegetative straw mulch, as described in Change Order No. 1.

Processing of the soil-cement aggregate from the borrow area began on October 21, 1986 after the screen plant and conveyor belts were assembled. The material in the borrow area was a mixture of sand and aggregate. A fine layer of grey beach sand, of 1 to 2 foot depth, was successfully mixed with the other sand and aggregate to achieve a more uniform product. Pockets of coal material were encountered in the borrow area and disposed in the waste area. Soil cement aggregate processing was completed on November 23.

Unclassified excavation was removed from between Stations 24+50 to 33+50 and stockpiled in the waste area. This material was later used in the compacted backfill.

The plan for the SHADWELL CREEK FIRE PROJECT was based on field control points and aerial mapping. Contour intervals were accurate to 3 to 4 feet and not accurate enough for this type of construction. Further survey work was required to record accurate contours and elevations, set slope stakes, and mark the location of the soil-cement.

The location of the soil-cement was changed, after field work, to move the toe of the soil-cement 5 to 10 feet closer to the bank in two 300-foot areas. These adjustments were necessary to place the soil-cement on stable riverbank, follow the natural flow of the river, and prepare for the irrigation ramp.

During the unclassified excavation, the Contractor had to preserve and protect the boreholes used for temperature monitoring. The Contractor excavated materials down to and around each borehole with the D-7 Dozer and TS-18B Scrapers, then used the P & H Backhoe to remove the remaining material

and slope the bank. Preservation of the boreholes was necessary to keep accurate records of the before and after effect of the soil seal.

Weather presented problems in both the fall construction of 1986 and spring/summer construction of summer 1987. Heavy rains in the fall saturated the gravel source and the screen plant could not operate efficiently. Later this same material affected the moisture control in the batch plant, requiring constant monitoring of the water supply. Snow and cold weather shut down the job in November of 1986 for two weeks.

During the spring/summer of 1987, heavy rains shut the project down three times. The haul roads were too slick to work on and truck traffic was impossible. The moisture content of the aggregate pile increased and the Contractor had to mix the wetter aggregate with drier aggregate to keep the aggregate feed from clogging. The rain also caused the river to rise, approaching the top of the dike in some instances, causing extra dewatering, wetter subgrades, and slick surfaces. Fortunately, the winter snowpack was low and the river did not rise over the top of the dike. Hot weather caused problems also. The soil-cement aggregate required more moisture and more water was needed for curing.

The project was shut down for the winter on November 26, 1986, the Resume Work Order issued on April 13, 1987, and work began on-site on April 20, 1987.

The Contractor requested authorization to work 10 to 12 hours per day and possibly 7 days a week until the soil-cement portion of the project was complete. This was approved by the Department of State Lands.

Unclassified excavation was resumed between Stations 24+50 and 33+00. The material was placed in the waste area and separated into gravel piles and clay piles. Later it was mixed and used for compacted embankment. The excavation in the beginning of the project began by utilizing two dozers preparing the slope between Stations 12+50 to 22+50. The material from this area was all used to construct the temporary dike.

During excavation, the riverbank continued to slough at various locations. In the fall of 1986, a crack formed in the bank at river level between Stations 14+00 and 16+00. This occurred after the water level rose and fell from the heavy rains. In the spring of 1987, this same area slid further out into the river as the dozers were working in that area. A small slide area developed higher up on the backslope of approximately 2 to 3-foot drop.

The haul road between Station 20+00 and 22+00 developed a crack also. This area is where elevated temperatures were recorded and the coal fire smoke was the most extreme after the rain. The slide in this area dropped approximately 2 feet and the backslope slid towards the river. The subgrade at Station 21+08 had a spring that required extra excavation 4-1/2 feet below subgrade, 15-feet long by 10-feet wide. Five dump truck loads of soil-cement were placed in this area and stabilized the subgrade.

Another crack in the backslope developed between Stations 25+00 and 27+00. This occurred overnight when no one was working in the area. The dozer operator reported that the ground dropped vertically 8 feet. Later, while equipment was operating in the area, another slide occurred, this time approximately 2 feet dropped.

No one was injured or equipment damaged in these occurrences. Pictures were taken and included in the slide documentation.

The temporary dike was built with the material from the excavation of the riverbank slopes. Two dozers were used to cut the slope down and push material out in the river. The P & H backhoe began excavating to the subgrade elevation of 925' and used the excavated material to build the dike to a uniform shape. The Bomag roller was used to compact the dike. The subgrade was excavated to a width typically 14-feet wide because a 3-foot by 2-foot deep ditch was necessary for dewatering and the Jersey Spreader required 11-feet of room to work.

In Phase I of the project, 1000 feet of subgrade was prepared. Portions of the dike leaked and pumping was required to remove the water from the subgrade. Settlings ponds were built at Station 24+00 and drain pipe installed to drain the water from the subgrade. In Phase II of the project, the water was removed at the same time as the dike was being constructed and the first layer of soil-cement was being placed. The Contractor would prepare a 200-300 foot area of subgrade, dewater it and place soil-cement all in the same day. This method of placement in Phase II worked the best because the subgrade was difficult to dewater. Placing one 16-inch thick lift on the subgrade helped to stabilize the subgrade for heavy equipment to work over. The soil-cement stabilized the subgrade rapidly. In the short time that one truck dumped and the other one arrived, the soil cement had set up sufficiently for the next dump truck to drive on the fresh soil-cement.

Construction of the batch plant took place while the

unclassified excavation and the dike were being built. Mobilization of the equipment for the batch plant was complete by May 1, 1987. The Contractor had purchased two new scales for this project, one for the cement feed and the other for the aggregate conveyor belt. The scales were adjusted by a factory representative and soil-cement began placement on May 11, 1987.

The batch plant consisted of an aggregate hopper with a conveyor belt, a cement truck was located nearby with the cement conveyor belt and scale set up to add cement to the aggregate conveyor belt. Two more cement trucks were used to store cement and fill the first cement truck. With this equipment, 50 to 60 tons of cement could be stored on-site. Following the aggregate conveyor belt was another conveyor belt which had a second scale used to measure the weight of the cement and aggregate. From this conveyor belt, the mix dropped into a trammel where water was added and the final mixing of the cement and aggregate was completed. After mixing in the trammel, the soil-cement traveled by a long, 100-foot conveyor belt to a storage hopper with conveyor belt. This hopper could store approximately 4 cubic yards and the conveyor belt was driven by a diesel engine operated by the truck drivers. In this manner, the soil-cement plant could continue to operate while the trucks alternately filled and dumped their loads.

Power for the plant was provided by a GMC diesel engine mounted in a 28-foot trailer. All the controls for the cement scale, aggregate conveyor belts and scale, trammel, water pump and 100-foot conveyor belt were connected to the power plant. The operator of the plant could shut off all of the batch plant in case something went wrong. The plant would be shut down most often because one of the trucks returning late and the 4 cubic yard hopper was filled to capacity. Occasionally, the aggregate hopper would clog due to moisture in the aggregate and the plant would have to be shut down.

The aggregate was fed to the hopper by a Caterpillar 966 front-end loader. During the wetter days on the project, the loader would mix dry material from the stockpile with the wetter material from the stockpile to provide material of consistent in-place moisture. The water was fed through the trammel and had to be adjusted for the proper moisture content. The in-place moisture can change rapidly and various methods became useful to tell the proper amount of moisture. The hand squeeze test, as described in the Soil Cement Inspector's Manual, was used most often. The moisture-density test of weighing and drying a sample was also used to validate what had been determined by the hand squeeze test. The nuclear densometer, used at the placement

of the soil-cement, recorded the moisture content of the material and this information was used to adjust the moisture. Visual inspection was also useful. The manner in which the soil-cement piled up as it was loaded in the dump trucks indicated too much moisture if the material spread out too flat and too little moisture if it piled up too high without some slump. The plant operators and truck drivers were conscientious in monitoring the proper moisture content and keeping it in proper adjustment.

Placement of the soil cement began at Station 12+50 and ended at Station 22+50 with one 16-inch lift. The trucks dumped the material on the subgrade and the JD 310 backhoe spread the soil-cement to the desired elevation and location. Placement of these lower lifts from Station 22+50 to the beginning at Station 12+50 took three working days to complete. The Jersey spreader was then used to place 8-inch lifts. The 45 degree corner at Station 13+00 was too sharp to operate the Jersey spreader and this area had to be spread by the JD 310 backhoe (this was also the same on the 45 degree corner at the end of the project). The Jersey spreader had limited mobility because it was mounted on a D-7 dozer and the tracks would tear up the fresh soil-cement on a sharp corner. Dewatering had to continue until the soil-cement was over 930 foot elevation.

Work continued on Phase I of the soil-cement until finish grade at elevation 938.3 was reached. A ramp was left in place from Station 22+50 to 17+00 and connected to the Phase II soil-cement by construction joints. The preliminary portion of the irrigation pump pad for the landowner was included in Phase I construction.

The trucks had trouble negotiating the narrow width of the soil cement and occasionally backed off the edge and had to be pulled out with the dozer. In some areas, especially the lower lifts, the backslope was wet clay material that the trucks would get stuck in and also need to be towed out. Three trucks were typically used and could adequately keep up with the batch plant on most occasions.

Compaction was achieved by operating a Bomag smooth drum vibratory roller on each 8" lift. Various combinations of compaction methods were tested and the best method was 2 passes with no vibrating and 4 passes vibrating. Over compaction caused the soil-cement to spread out and cracks would form on the outer edge. Under compaction did not reach the required density. All compaction tests were taken using the 6-inch depth for the probe on the Nuclear Densometer because an 8-inch depth would have recorded readings from the lower lift. The moisture readings for the soil-cement were recorded with the Nuclear Densometer and

compared closely to the laboratory moisture-density tests.

The placement of soil-cement on Phase I of the project began on May 11, 1987. The soil-cement was completed 11 working days later on May 27, 1987. Phase II of the project soil-cement placement was between May 28 to June 4, 1987 and June 15 to June 23, 1987. A total of 13 working days were necessary for soil-cement placement on Phase II.

Placement of soil-cement on Phase II of the project began at Station 22+50 and proceeded to Station 33+50. The Contractor excavated 200 to 300 feet daily and placed one 16" lift on the subgrade to stabilize the soil. Thereafter, 8" lifts were placed and compacted. The length of soil cement placed depended on the amount of subgrade the backhoe could prepare daily. This method reduced the amount of dewatering and improved the efficiency of the operation.

Placement of Phase II soil-cement continued to elevation 932, then work on the soil-cement was suspended until portions of the dike on Phase II were removed. The Contractor utilized the smaller JD 310 backhoe, the larger JD 690 backhoe and the 966 Caterpillar loader to excavate and load 3 dump trucks and 1 scraper. The dike material was hauled to the Phase I portion of the job and used as compacted backfill or placed in the waste area.

After removing portions of the dike, work resumed on the Phase II soil-cement. The preliminary irrigation pump pad was constructed and the soil-cement completed to elevation 938.3. The final lift of soil-cement varied in thickness. A level was used to record elevations along the top of the soil-cement, stakes were marked to finish grade, and the Contractor finished the soil-cement to final grades.

Numerous delays slowed the completion of the soil-cement. The Contractor had 5 days of rain stop work, extra work on the subgrade, problems in delivery of cement, and equipment breakdowns.

Testing of the soil-cement included the use of a Troxler Nuclear Densometer on the soil-cement for in-place moisture density. A mobile field testing laboratory with Proctor molds, 3 burner stoves, oven, sample splitter, 2 Gibson sieve analysis, scales and miscellaneous equipment were located near the batch plant for testing purposes. Soil-cement molds were formed in the 1/30 cubic foot Proctor mold for compressive strength tests. Moisture density tests were taken on the soil-cement and soil-cement aggregate. Rainfall on the soil-cement stockpile affected the moisture control for the plant site and constant attention was necessary on the amount of water added to the soil-cement

mix.

Compacted backfill was then placed over the completed soil-cement. Materials stored in the waste area were used for this operation. The Contractor mixed gravel material with clay material during placement. Before reaching finish grade, the Bomag vibratory roller was used to compact the material and a water truck hauled water to add moisture. The Bomag roller slid over the edge of the fill and had to be pulled up by cables attached to the D-7 dozer. The operator jumped off in time to avoid personal injury. The roller slid down the compacted fill, over the soil cement, and struck the front drum into the dike. There was no damage to the roller.

The Contractor requested to leave portions of the temporary dike in place because the saturated material was unsuitable for backfill and was not possible to remove when needed to complete the compacted backfill. The impact of the Yellowstone River would be reduced by letting the material erode slowly over a longer period of time. A shortage of material developed due to backfill material remaining in the dike. The Contractor asked to remove suitable material from an approved source. Materials for compacted backfill were removed by borrowing excavation from the backslope between Stations 20+00 to 33+00.

Two amendments to the original permit with the Corps of Engineers were applied for on August 4, 1987. The Contractor requested that the permit be modified to allow the dike to remain in place. The Landowners requested an expanded irrigation pump pad. Since the original permit for the reclamation work was issued to the Department of State Lands, these amendments were requested by the Department of State Lands.

The compacted backfill was completed and three borehole casings were cut off with a torch so the temperature probes could be recorded. There was over 20 feet of excavation removed from around these boreholes which made them inaccessible.

A temporary shut down was issued for July 16, 1987. The Contractor stopped work until the results of the amendment to the Corps of Engineers permit were known. Remaining items of work were replacing topsoil, seeding, fertilizing, mulching, borehole drilling and fence building.

The Corps of Engineer approved both amendments to the permit on October 9, 1987.

The Resume Work Order for the SHADWELL CREEK FIRE PROJECT

was issued on October 27, 1987 and the Contractor began reclamation work on the same day.

The irrigation pump pad requested by the Landowners was built by placing gabion baskets filled with oversized rock from the stockpile produced from the soil-cement aggregate screening. Rock fill was placed around these baskets and 8 inches of concrete poured to provide a stable pad for the pump.

Plastic and steel pipe with fittings were installed in the irrigation pump pad access road from the soil-cement embankment to the corner of the Landowners field.

Topsoil was replaced over the entire project and revegetated. The fence separating both Landowners was replaced and a gate installed for access to both areas. Work was completed on the SHADWELL CREEK FIRE PROJECT on November 20, 1987.

On January 19, 1988, a meeting was held in the offices of L.C. Hanson Company to discuss the final quantities of the project. Representatives from the Department of State Lands, L.C. Hanson Company and Montgomery Construction were in attendance. The Contractor and the Department of State Lands came to an agreement to reduce the final cost of the project by $10,080.00, to compensate for leaving portions of the temporary dike on the banks of the river.

III. COST AND QUANTITY SUMMARY

A. FINAL PAYMENT REQUEST AND RECONCILIATION CHANGE ORDER

Copies of the Final Payment Request and Reconciliation Change Order for the SHADWELL CREEK FIRE PROJECT are contained in Appendix A. These documents summarize the final quantities and costs for each work item.

B. CHANGE ORDERS

Change Order No. 1 - Shaping and Mulching Topsoil Stockpile and Other Areas for Protection from Winter Wind Erosion.

High winds normally occur during the winter and spring months in this area and could adversely affect the topsoil piles. After construction in the fall of 1986, the topsoil piles and other disturbed areas were protected from erosion from wind by the application of vegetative mulch.

Change Order No. 2 - Subgrade Preparation for the Soil-Cement and Pump Pad on Irrigation Access Ramp.

Areas of the subgrade for the soil-cement required extra work before placement of soil-cement. Deleterious material had to be removed and extra excavation in various areas including the spring at Station 21+08.

Change Order No. 3 - Dozer Shaping an Area Along the Access Road with a D-7 Caterpillar Before and After Backfilling by Scrapers.

The Landowners requested a hole along the access road be filled with waste material from the excavation. The Owner approved the area to be shaped by a CAT D-7 dozer to allow the scrapers to load, haul and place unclassified excavation in the hole. The quantity was measured by load count, no compaction was required and the dozer shaped the area and spread topsoil after the hole was filled.

Remove Casing Pipe from Boreholes #10, #13 and #17.

After completing the unclassified excavation and compacted backfill, three preliminary boreholes protruded in their 5" steel casing 20 to 40 feet above ground. Recording temperatures from these boreholes was not possible. The P & H backhoe was used to steady the borehole by wrapping a chain around the casing. A mechanics truck with a torch cut through the casing and a laborer held the chain on the casing.

Change Order No. 4 - CANYON CREEK MAINTENANCE

Revegetation work and installation of a Hold-Gro Erosion Mat on the steep slope on the CANYON CREEK Reclamation Project to control erosion.

Irrigation Access Ramp and Pump Pad - The Landowner requested improvements on the irrigation access ramp and pump pad. Gabion baskets were installed and filled with rock from the oversize rock screened from the soil-cement aggregate. An 8-inch concrete pad was poured over the gabion basket foundation to provide room to operate a portable pump. Twelve-inch plastic and steel pipes with the necessary fittings were installed in the access road. Connections were provided at the irrigation pump pad and at the corner of the Landowners' field for the pump and irrigation pipe.

Credit for Not Removing Dike - The Contractor requested the following changes: Allow the material used to build the temporary dike to remain in place because the saturated material was unsuitable for compacted backfill and complete the compacted backfill utilizing another excavation source. This would reduce the impacat on the Yellowstone River by

letting the material erode slowly over a longer period of time. A revision to the Corps of Engineers permit was applied for on August 4, 1987 and approved by the Corps on October 9, 1987. The Contractor and Owner agreed to reduce the cost of the project by $10,090.00. Work on the project was completed in November of 1987.

Reconciliation of Quantities - The actual quantities shown were necessary to meet the field conditions encountered during construction.

C. COSTS PER UNIT

ITEM		TOTAL COST	UNIT	COST/UNIT
MOBILIZATION		$ 20,000.00	LUMP SUM	$20,000.00/LS
SALVAGE AND REPLACE TOPSOIL		$ 41,262.60	13754.2 CY	$ 3.00/CY
CONSTRUCT TEMPORARY DIKE ELEVATION 927	*	$ 43,300.00	2165 LF	$ 20.00/LF
CONSTRUCT TEMPORARY DIKE ELEVATION 929	*	$ 4,330.00	2165 LF	$ 2.00/LF
CONSTRUCT TEMPORARY DIKE ELEVATION 931	*	$ 4,330.00	2165 LF	$ 2.00/LF
UNCLASSIFIED EXCAVATION	*	$145,702.93	63,349.1 CY	$ 2.30/CY
EMBANKMENT		$ 48,517.20	32344.8 CY	$ 1.50/CY
SOIL-CEMENT EMBANKMENT		$ 97,495.30	9948.5 CY	$ 9.80/CY
FURNISH CEMENT		$ 94,904.60	1186.3 TON	$ 80.00/TON
BOREHOLE DRILLING & BANK FILLING - 4-3/4" DIAMETER		$ 1,256.00	157 LF	$ 8.00/LF
CASING PIPE		-0-	-0-	-0-
PROVIDE TOPSOIL - IMPORTED		-0-	-0-	-0-
SEED		$ 11,235.00	535 LBS	$ 21.00/LB
FERTILIZER		$ 485.25	1617.5 LBS	$ 0.30/LB
WOOD FIBER MULCH		$ 2,970.00	9000 LBS	$ 0.33/LB
VEGETATIVE STRAW MULCH		$ 6,600.00	33000 LBS	$ 0.20/LB
FARM FENCE - F-3W		$ 195.00	130 LF	$ 1.50/LF
SINGLE PANEL		$ 300.00	3 LF	$ 100.00/LF
DOUBLE PANEL		$ -0-	-0-	-0-
FARM GATE - TYPE G-2		$ 80.00	16 LF	$ 5.00/LF

ITEM	TOTAL COST	UNIT	COST/UNIT
IRRIGATION ACCESS RAMP	$ 3,000.00	LUMP SUM	$ 3,000.00/LS
SHAPE TOPSOIL STOCKPILES	$ 1,521.00	19.5 HRS	$ 78.00/HR
MULCH TOPSOIL STOCKPILES AT 4000 LBS/ACRE	$ 1,908.00	6360 LBS	$ 0.30/LB
MULCH DISTURBED AREAS AT 2000 LBS/ACRE	$ 2,000.70	7410 LBS	$ 0.27/LB
SUBGRADE PREPARATION	$ 330.00	7.5 HRS	$ 44.00/HR
BACKFILL LANDOWNER HOLE	$ 467.50	5.5 HRS	$ 85.00/HR
REMOVE CASING PIPE	$ 222.00	1.5 HRS	$ 148.00/HR
CANYON CREEK - SEED	$ 151.20	7.2 LBS	$ 21.00/LB
HOLD-GRO EROSION MAT	$ 1,401.00	467 SY	$ 3.00/SY
EQUIPMENT RENTAL	$ 300.00	5 HRS	$ 60.50/HR
ROCK FILL	$ 180.00	30 CY	$ 6.00/CY
CONCRETE CLASS AD - 5 SACK MIX	$ 12,456.00	72 CY	$ 173.00/CY
GABION BASKETS	$ 9,540.00	106 CY	$ 90.00/CY
FITTINGS AND MISC.			
12" STEEL PIPE 18' LONG	$ 25.00	1 EACH	$ 25.00/EA
18" STEEL PIPE 20' LONG	$ 151.25	1 EACH	$ 151.25/EA
12" STEEL 45° BEND	$ 50.10	1 EACH	$ 50.10/EA
12" PVC CLASS 100	$ 294.00	60 LF	$ 4.90/LF
12" COMPRESSION COUPLINGS	$ 567.60	4 EACH	$ 141.90/EA
12" STEEL FLANGED 90° NRMF	$ 410.94	1 EACH	$ 410.94/EA
VISQUEEN FOR CONCRETE COVER	$ 200.00	LUMP SUM	$ 200.00/LS
STRAW FOR CONCRETE COVER	$ 574.00	2870 LBS	$ 0.20/LB
8" STEEL FLANGE 90° BEND	$ 145.05	1 EACH	$ 145.05/EA
PROFIT & OVERHEAD - 10%	$ 2,459.39	LUMP SUM	$ 2,459.39/EA
EQUIPMENT RENTAL			
310 BACKHOE	$ 1,452.00	33 HRS	$ 44.00/HR

ITEM	TOTAL COST	UNIT	COST/UNIT
D-7 DOZER	$ 1,402.50	16.5 HRS	$ 85.00/HR
TS-18 SCRAPER	$ 190.00	2.0 HRS	$ 95.00/HR
DUMP TRUCK	$ 330.00	5.5 HRS	$ 60.00/HR
WELDER	$ 160.00	4.0 HRS	$ 40.00/HR
CREDIT FOR NOT REMOVING DIKE	$ 10,080.00	LUMP SUM	-$10,080.00/
TOTAL	$554,772.51	18.0 ACRE	$30,820.69/AC

* Total Disturbed Areas

IV. SUMMARY

The SHADWELL CREEK FIRE reclamation was completed on November 20, 1987. The final cost of the project was $554,772.15. The majority of the increased costs were due to increases in topsoil, unclassified excavation, compacted backfill, soil-cement backfill, cement and the Change Order to build an irrigation access ramp and pump pad.

B. DISCUSSION

The methods used to build the soil-cement embankment have been noted in the Work Description. There are some areas that could be improved upon in future projects.

The design for the SHADWELL CREEK FIRE project placed the soil-cement on a flat subgrade below normal water elevation. It was evident that water leaking through the dike would present a problem and noted in the Contract Documents. The Contractor was responsible for dewatering the area behind the dike to prevent the supersaturation of the subgrade.

During construction the Contractor built a 2-foot deep and 3-foot wide trench for dewatering. Pumps were installed in various locations and used to drain the water. As soil-cement was placed, the dewatering trench was filled and formed a key way on the river side of the soil-cement. This enabled the Contractor to have a larger area to work, form a solid base for the soil cement embankment and provided stability. The key way used for dewatering and filled with soil cement should be included on future projects that have similar conditions.

Building the soil-cement on a 1-1/2:1 slope was necessary on this project to reduce the amount of unclassified excavation. Problems developed during construction because the equipment used to place the soil cement would compact the material to form a natural 1-1/2:1 slope. The end product then became a smooth slope and not the stair-step fashion depicted on the Plans. The 1-1/2:1 slope should, wherever possible, be made a 2: 1 slope or flatter in order to properly finish the sides.

The JD 310 backhoe was used extensively during soil-cement embankment. The front bucket of the backhoe was equipped with a wheel and used to roll the outside edges of the soil cement. This method satisfactorily compacted the edges of the soil-cement, but if the slope was a 2:1 or flatter, a stair-step slope would have been achieved.

There were other uses for the JD 310 backhoe that made it invaluable during construction. As the first lift of soil-cement was being placed on the saturated subgrade, the dump trucks unloaded the soil-cement and the backhoe spread it to the required width and depth. Material had to be filled between the soil-cement and the bank after the Jersey Spreader placed the soil cement, which the backhoe placed. Then the outside of the soil-cement had to be wheel-rolled and shaped to a uniform slope. The backhoe operator was very adept at operating the JD 310.

Curing of the soil-cement on this project was included in the cubic yard bid for Soil Cement Embankment. Water was applied by use of a water truck with attachments to spray water on the top of the soil-cement and on the slopes. The Contractor provided sufficient amounts of water for curing to adequately cure the soil-cement. A certain amount of complaints were registered from the Contractor on the curing and it is suggested that cost incentives be added in future projects to achieve a better end product.

On this project, it was noted that a water system attached to the recently-completed soil-cement made of small diameter PVC pipe with a water pump and sprinklers could have been used to keep a continuous water spray on the soil-cement. The importance of applying a good cure to the soil-cement is integral to the quality of the soil-cement and measures should be taken to insure proper cure.

Topsoil salvaged on the project was double the estimated amount. The Contractor utilized a unique method of spreading topsoil on the 2:1 slopes of the compacted backfill. A scraper hauled topsoil to the flat area above the slopes. Two D-7 dozers were connected to a cable, then

one D-7 spread topsoil down the slope while the other D-7, attached by cable, followed on the flat area. When the topsoil was spread to the bottom, the D-7 on the flat area pulled the other D-7 back up the slope. A D-7 is capable of climbing a 2-1/2:1 slope or flatter under its own power, but cannot manage to climb a 2:1 slope without assistance.

The existing boreholes on the project were to be preserved because of the initial cost of drilling the boreholes and for future monitoring to record the effect of the soil seal on the coal fire. There were 20 boreholes of various depths encased in 5" steel casing that the Contractor was required to work around. The excavation around the boreholes was accomplished by excavating with scrapers and dozers then removing and shaping the slope with the backhoe. After excavation was completed, compacted backfill was constructed around the temperature probe wires. Change Order No. 3b was necessary to cut through the 5-inch steel casing and remove it. After the casing was removed, wire connections were made and temperatures recorded.

The Landowners requested that an irrigation pump pad and access ramp be constructed. The preliminary plan was not adequate for their needs and the irrigation pump pad and access ramp were expanded. The resulting work should allow good access to the river. Construction of the pump pad was on part of the material left in the river from the temporary dike.

Close communication with the Landowners could have resulted in better planning for the irrigation pump pad, but the Landowners had difficulty understanding engineering plans and specifications and the need for advanced planning.

V. SLIDE LOGS

The Slide Logs are included in Appendix B.

APPENDIX A

Payment Request No. 6 (Final)

From: October 27, 1987 To: November 20, 1987

Project Name: Shadwell Creek Fire Project

Location: Richland Co. Mt. Project No.: Mont A/E 86-46-113

Name Of Contractor: Montgomery Const. Address: P.O. Box 755 Hilger Mt. 59451

Summary Of Project Status

Amount of Original Contract	$422,518.40
Amount of Approved Change Order(s)	132,254.11
TOTAL CONTRACT AMOUNT	554,772.51
Contract Time Used to Date	154 Days
Percentage of Contract Time Used	90%
Percentage of Contract Amount Earned	100%

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Original Contract Amount Completed		525,963.28
Change Order(s) Amount Completed		28,809.23
Amount for Materials On Site		0.00
TOTAL To Date		554,772.51
Times 90% =	No Retainage	
TOTAL AMOUNT Earned To Date		554,772.51
Less Previous Amount Earned		412,401.24
Amount Payable This Period		142,371.27
Less 1% Gross Receipts Tax		1,423.71
TOTAL DUE CONTRACTOR THIS PERIOD		$140,947.56

Requested By: Montgomery Const. [signature] (Contractor) Date: 1-25-88

Checked By: L.C. Hanson Co. Allen W. Tye (Engineer) Date: 1/26/88

Approved By: Department of State Lands [signature] (Owner) Date: 2/3/88
Abandoned Mine Reclamation Bureau

PAY REQUEST NO. 6

L.C. HANSON CO.

PROJECT: Shadwell Creek Fire Project MONT A/E 86-46-113 Page 2 Of 7

ITEMIZATION OF QUANTITIES AND COSTS

ITEM NO.	DESCRIPTION	ESTIMATED PLAN QUANTITY	UNIT BID PRICE	UNITS OF WORK COMPLETED THIS REQUEST	UNITS OF WORK COMPLETED TO DATE	TOTAL COST OF COMPLETED WORK	% OF EST. QUANT. COMP.
1	Mobilization	1.0 L.S.	20000.00	0.00	1.00	20000.00	100*
2	Salvage & Replace Topsoil	7000.0 C.Y.	3.00	0.00	13754.20	41262.60	100*
3a	Const. Temp Dike Elev 927	2110.0 L.F.	20.00	420.00	2165.00	43300.00	100*
3b	Const. Temp Dike Elev 929	2110.0 L.F.	2.00	420.00	2165.00	4330.00	100*
3c	Const. Temp Dike Elev 931	2110.0 L.F.	2.00	420.00	2165.00	4330.00	100*
4	Unclassified Excavation	41818.0 C.Y.	2.30	7934.10	63349.10	145702.93	100*
5	Embankment	26449.0 C.Y.	1.50	605.00	32344.80	48517.20	100*
6	Soil-Cement Embankment	8500.0 C.Y.	9.80	0.00	9948.50	97495.30	100*
7	Furnish Cement	800.0 Ton	80.00	0.00	1186.30	94904.00	100*
8	Borehole Drilling & Backfilling 4-3/4" Dia.	300.0 L.F.	8.00	157.00	157.00	1256.00	100*
9	Casing Pipe, 5" I.D.	90.0 L.F.	6.00	0.00	0.00	0.00	100*
10	Provide Topsoil -Imported	3000.0 C.Y.	5.00	0.00	0.00	0.00	100*
11	Seed	529.0 Lbs.	21.00	535.00	535.00	11235.00	100*
12	Fertilizer	1665.0 Lbs.	0.30	1617.50	1617.50	485.25	100*
13	Wood Fiber Mulch	9000.0 Lbs.	0.33	9000.00	9000.00	2970.00	100*
	Sub-Total					515788.28	

* Work completed on this item

PAY REQUEST NO. 6

L.C. HANSON CO.

PROJECT: Shadwell Creek Fire Project MONT A/E 86-46-113

ITEMIZATION OF QUANTITIES AND COSTS

ITEM NO.	DESCRIPTION	ESTIMATED PLAN QUANTITY	UNIT BID PRICE	UNITS OF WORK COMPLETED THIS REQUEST	UNITS OF WORK COMPLETED TO DATE	TOTAL COST OF COMPLETED WORK	% OF EST. QUANT. COMP.
14	Vegetative Straw Mulch	40500.0 lbs.	0.20	33000.00	33000.00	6600.00	100*
15	Farm Fence - F3W	1750.0 L.F.	1.50	130.00	130.00	195.00	100*
16	Single Panel	8.0 Ea.	100.00	3.00	3.00	300.00	100*
17	Double Panel	3.0 Ea.	200.00	0.00	0.00	0.00	100*
18	Farm Gate - Type G-2	16.0 L.F.	5.00	16.00	16.00	80.00	100*
19	Irrigation Access Ramp	1.0 L.S.	3000.00	0.40	1.00	3000.00	100*
	Sub-Total					10175.00	
	Total Excluding C.O.s					525963.28	

* Work completed on this item

PAY REQUEST NO. 6

L.C. HANSON CO.

PROJECT: Shadwell Creek Fire Project MONT A/E 86-46-113

ITEMIZATION OF QUANTITIES AND COSTS

ITEM NO.	DESCRIPTION	ESTIMATED PLAN QUANTITY	UNIT BID PRICE	UNITS OF WORK COMPLETED THIS REQUEST	UNITS OF WORK COMPLETED TO DATE	TOTAL COST OF COMPLETED WORK	% OF EST. QUANT. COMP.
	Change Order No. 1						
1a	Shape Topsoil Stockpiles						
	For Mulch. -Cat D-7 Dozer	20.0 Hrs.	78.00	0.00	19.50	1521.00	100*
1b	Mulch Topsoil Stockpiles						
	w/4000 lbs/acre	8000.0 Lbs.	0.30	0.00	6360.00	1908.00	100*
1c	Mulch Other Dist. Areas						
	w/3000 lbs/acre	6000.0 Lbs.	0.27	0.00	7410.00	2000.70	100*
	Subtotal					5429.70	
	Change Order No. 2						
2a	Subgrade Preparation						
	J.D. 310 Backhoe	7.5 Hrs.	44.00	0.00	7.50	330.00	100*
	Subtotal					330.00	
	Change Order No. 3						
3a	Backfill Landowner hole						
	Cat D-7 Dozer	5.5 Hrs.	85.00	0.00	5.50	467.50	100*
	Subtotal This Page					6227.20	

* Work completed on this item

PAY REQUEST NO. 6

L.C. HANSON CO.

PROJECT: Shadwell Creek Fire Project MONT A/E 86-46-113

ITEMIZATION OF QUANTITIES AND COSTS

ITEM NO.	DESCRIPTION	ESTIMATED PLAN QUANTITY	UNIT BID PRICE	UNITS OF WORK COMPLETED THIS REQUEST	UNITS OF WORK COMPLETED TO DATE	TOTAL COST OF COMPLETED WORK	% OF EST. QUANT. COMP.
	Change Order No. 3 (Cont.)						
3b	Remove Casing Pipe from						
	BH's #10,#13, & #17						
	P & H Backhoe	1.5 Hrs.	88.00	1.50	1.50	132.00	100*
	Mechanics Truck	1.5 Hrs.	40.00	1.50	1.50	60.00	100*
	Laborer	1.5 Hrs.	20.00	1.50	1.50	30.00	100*
	Subtotal					689.50	
	Change Order No. 4						
4a	Canyon Creek Maint. Project						
	Seed	7.2 Lbs.	21.00	7.20	7.20	151.20	100*
	Hold- Gro Erosion Mat	467.0 Sq.Yd.	3.00	467.00	467.00	1401.00	100*
	Equipment Rental JD 310						
	Backhoe	5.0 Hrs.	60.00	5.00	5.00	300.00	100*
	Subtotal This Page					2074.20	

* Work completed on this item

PAY REQUEST NO. 6

L.C. HANSON CO.

PROJECT: Shadwell Creek Fire Project MONT A/E 86-46-113 Page 6 Of 7

ITEMIZATION OF QUANTITIES AND COSTS

ITEM NO.	DESCRIPTION	ESTIMATED PLAN QUANTITY	UNIT BID PRICE	UNITS OF WORK COMPLETED THIS REQUEST	UNITS OF WORK COMPLETED TO DATE	TOTAL COST OF COMPLETED WORK	% OF EST. QUANT. COMP.
	Change Order No. 4 (Cont.)						
4b	Irrigation Access Ramp						
	Rock Fill	30.0 C.Y.	6.00	30.00	30.00	180.00	100*
	Concrete Class AD	72.0 C.Y.	173.00	72.00	72.00	12456.00	100*
	Gabion Baskets	106.0 C.Y.	90.00	106.00	106.00	9540.00	100*
	12" Steel Pipe, 18' long	1.0 EACH	25.00	1.00	1.00	25.00	100*
	12" Steel Pipe, 20' long	1.0 EACH	151.25	1.00	1.00	151.25	100*
	12" Steel 45 Degree Bend	1.0 EACH	50.10	1.00	1.00	50.10	100*
	12" PVC Class 100	60.0 L.F.	4.90	60.00	60.00	294.00	100*
	12" Compression Coupling	4.0 EACH	141.90	4.00	4.00	567.60	100*
	12" Steel 90 Degree Bend	1.0 EACH	410.94	1.00	1.00	410.94	100*
	Visqueen for Concrete	1.0 L.S.	200.00	1.00	1.00	200.00	100*
	Straw for Concrete Cover	2870.0 LBS.	0.20	2870.00	2870.00	574.00	100*
	8" Steel 90 Degree Bend	1.0 EACH	145.05	1.00	1.00	145.05	100*
	Subtotal					24593.94	
	Profit & Overhead +10%					2459.39	
	Subtotal This Page					27053.33	

* Work completed on this item

L.C. HANSON CO.

PROJECT: Shadwell Creek Fire Project MONT A/E 86-46-113

ITEMIZATION OF QUANTITIES AND COSTS

ITEM NO.	DESCRIPTION	ESTIMATED PLAN QUANTITY	UNIT BID PRICE	UNITS OF WORK COMPLETED THIS REQUEST	UNITS OF WORK COMPLETED TO DATE	TOTAL COST OF COMPLETED WORK	% OF EST. QUANT. COMP.
	Change Order No. 4 (Cont)						
	Irrigation Access Ramp (Cont)						
	Equipment Rental						
	310 Backhoe	33.0 Hrs.	44.00	33.00	33.00	1452.00	100*
	D-7 Dozer	16.5 Hrs.	85.00	16.50	16.50	1402.50	100*
	TS-18 Scraper	2.0 Hrs.	95.00	2.00	2.00	190.00	100*
	Dump Truck	5.5 Hrs.	60.00	5.50	5.50	330.00	100*
	Welder	4.0 Hrs.	40.00	4.00	4.00	160.00	100*
4c	Credit for not Removing Dike	1.0 L.S.	-10080.00	1.00	1.00	-10080.00	100*
4D	Reconciliation of Final						
	Quantities	1.0 L.S.	103294.58	1.00	1.00	103294.58	100*
	Subtotal					125654.61	
	Subtotal This Page					96749.08	
	Total for All Change Orders					132103.81	

* Work completed on this item

SECTION II

2.12 CHANGE ORDER Order No. 4

Date: January 22, 1988

Agreement Date: October 3, 1986

NAME OF PROJECT: SHADWELL CREEK FIRE PROJECT

Richland County, MT MT A/E 86-46-113

OWNER: MONTANA DEPT. OF STATE LANDS - ABANDONED MINE RECLAMATION BUREAU

CONTRACTOR: MONTGOMERY CONSTRUCTION, PO Box 755, Hilger, MT 59451

Change Orders must be accompanied by an itemized cost breakdown. You are hereby requested to comply with the following changes from the Contract Documents. (Show separate costs for materials, labor, equipment and miscellaneous. Show percent where applicable.)

ITEM NO.	DESCRIPTION OF CHANGES - ESTIMATED QUANTITIES & UNITS	COST OF CHANGES					TOTAL COST
		MAT'LS	LABOR	EQUIP.	MISC.	TOTAL UNIT COST	
	(SEE PAGES 3 AND 4 ATTACHED)						
	TOTAL COST - MAT'LS, LABOR, EQUIPMENT & MISC.						$125,654.61
	OVERHEAD & PROFIT @ Incl. %						---
	GRAND TOTAL - THIS CHANGE ORDER						$125,654.61

Original Contract Price	$422,518.40
Current Contract Price Adjusted by Previous Change Order	$429,117.90
Cost This Change Order (+ or -)	+$125,654.61
New Contract Price Including This Change Order	$554,772.51

The completion date as set forth in the Contract Documents shall be (~~unchanged~~, increased, ~~decreased~~) by Twelve (12) calendar days.

The date for completion of all work will be December 8, 1987.

Description and Justification for Change:

1. (SEE PAGE 5 ATTACHED)

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SURETY CONSENT

The surety hereby consents to the aforementioned Contract Change Order and agrees that its bond or bonds shall apply and extend to the Contract as thereby modified or amended per this Change Order. The principal and the Surety further agree that on or after execution of this consent, the penalty of the applicable Performance Bond or Bonds is hereby increased by ONE HUNDRED TWENTY FIVE THOUSAND SIX HUNDRED FIFTY FOUR & 61/1

($ 125,654.61--------) (One hundred percent (100%) of the Change Order amount) and the penalty of the applicable Payment Bond or Bonds is hereby increased by ONE HUNDRED TWENTY FIVE THOUSAND SIX HUNDRED FIFTY FOUR AND 61/100 ($125,654.61----------)

(One hundred percent (100%) of the Change Order amount).

COUNTERSIGNED BY MONTANA RESIDENT AGENT

COGSWELL AGENCY

BY Sandra Kay Kirk
RESIDENT AGENT

SURETY

CONTINENTAL CASUALTY COMPANY

BY: Sandra Kay Kirk
SANDRA KAY KIRK (Seal)

Recommended by: L. C. Hanson Company Alan W. Nye, Engineer Date 1/22/88

Accepted by: Montgomery Lorel Jo Montgomery, Contractor 1/25/88

Approved by: Richard Zier, Owner 2/3/88

ITEM NO.	DESCRIPTION OF CHANGES	COST OF CHANGES MATLS	LABOR	EQUIP	MISC	TOTAL UNIT COST	TOTAL COST
1.	DSL directed maintenance work to be performed on the CANYON CREEK Project						
	a. Seed - 7.2 lbs	21.00	---	---	---	21.00	$ 151.20
	b. Hold-Gro Erosion Mat - 467.0 Sq. Yd.	3.00	---	---	---	3.00	1401.00
	c. Equipment Rental J.D. 310 Backhoe - 5.0 Hrs	---	---	60.00	---	60.00	300.00
		Sub-Total					$ 1,852.20
2.	The landowner requested and DSL approved installation of Irrigation Access Ramp and Pump Pad						
	- Materials -						
	a. Rock Fill - 30.0 C.Y.	6.00	---	---	---	6.00	180.00
	b. Concrete Class AD - 77.0 C.Y.	173.00	---	---	---	173.00	12,456.00
	c. Gabion baskets - 106.0 C.Y.	90.00	---	---	---	90.00	9540.00
	d. 12" steel pipe, 18' long - 1.0 Each	25.00	---	---	---	25.00	25.00
	e. 12" steel pipe, 20' long - 1.0 Each	151.25	---	---	---	151.25	151.25
	f. 12" steel 45° bend - 1.0 Each	50.10	---	---	---	50.10	50.10
	g. 12" PVC Class 100 - 60 L.F.	4.90	---	---	---	4.90	294.00
	h. 12" compression coupling - 4 Each	141.90	---	---	---	141.90	567.60
	i. 12" steel 90° bend - 1.0 Each	410.94	---	---	---	410.94	410.94
	j. Visqueen for concrete - L.S.	200.00	---	---	---	200.00	200.00
	k. Straw for concrete cover - 2870 LBS	0.20	---	---	---	0.20	574.00
	l. 8" steel 90° bend - 1.0 Each	145.05	---	---	---	145.05	145.05
		Sub-Total					$ 24,593.94
	m. Profit and overhead - 10%				2459.39	2459.39	2,459.39
		Sub-Total					$ 2,459.39

ITEM NO.	DESCRIPTION OF CHANGES	COST OF CHANGES MATLS	LABOR	EQUIP	MISC	TOTAL TOTAL COST	TOTAL COST
	- Equipment Rental -						
	n. 310 Backhoe - 3.3 Hrs	---	---	44.00	---	44.00	1,452.00
	o. D-7 Dozer - 16.5 Hrs	---	---	85.00	---	85.00	1,402.50
	p. TS-18 Scraper - 2.0 Hrs	---	---	95.00	---	95.00	190.00
	q. Dump Truck - 5.5 Hrs	---	---	60.00	---	60.00	330.00
	r. Welder - 4.0 Hrs	---	---	40.00	---	40.00	160.00
	Sub-Total						$ 3,534.50
3.	Contractor requested leaving a portion of the temporary dike in place and provided a reduction in price of $10,080.00 to the final cost of the project						- 10,080.00
.	Reconciliation of Quantities (See Pages 6 and 7 attached)						+ 103,294.58
	TOTAL COST THIS CHANGE ORDER						$125,654.61

Change Order No. 4
SHADWELL CREEK

Justification -

1. CANYON CREEK MAINTENANCE PROJECT - Revegetation work and installation of a Hold-Gro Erosion Mat on the steep slopes on the CANYON CREEK RECLAMATION PROJECT to control erosion.

2. IRRIGATION ACCESS RAMP AND PUMP PAD - The landowner requested and the Owner directed the installation of an irrigation access ramp and pump pad. The permit from the Corps of Engineers was revised to permit this installation.

3. CREDIT FOR NOT REMOVING DIKE - The Contractor requested the following changes: Allow the material used to build the temporary dike to remain in place because the saturated material was unsuitable for compacted backfill and complete the compacted backfill utilizing another excavation source. This would reduce the impact on the Yellowstone River by letting the material erode slowly over a longer period of time. A revision to the Corps of Engineers permit was applied for on August 4, 1987 and approved by the Corps on October 9, 1987. The Contractor and Owner agreed to reduce the cost of the project by $10,080.00. Work on the project was completed in November of 1987.

4. RECONCILIATION OF QUANTITIES - The actual quantities shown were necessary to meet the field conditions encountered during construction.

Change Order No. 4
SHADWELL CREEK

RECONCILIATION OF FINAL QUANTITIES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	ACTUAL QUANTITY	CHANGE IN PRICE
2.	SALVAGE & REPLACE TOPSOIL	7000 CY	13,754.2 CY	+$ 20,262.60
3.	CONSTRUCT TEMPORARY DIKE TO:			
	A. ELEV. 927.0	2110 LF	2165 LF	+ 1,100.00
	B. ELEV. 929.0	2110 LF	2165 LF	+ 110.00
	C. ELEV. 931.0	2110 LF	2165 LF	+ 110.00
4.	UNCLASSIFIED EXCAVATION	41,818 CY	63,349.1 CY	+ 49,521.53
5.	EMBANKMENT	26,449 CY	32,344.8 CY	+ 8,843.70
6.	SOIL-CEMENT EMBANKMENT	8500 CY	9948.5 CY	+ 14,195.30
7.	FURNISH CEMENT	800 TON	1186.3 TON	+ 30,904.00
8.	BOREHOLE DRILLING & BACKFILLING - 4-3/4" DIAMETER	300 LF	157 LF	- 1,144.00
9.	CASING PIPE - 5" DIAMETER	90 LF	0 LF	- 540.00
10.	PROVIDE TOPSOIL - IMPORTED	3000 CY	0 CY	- 15,000.00
11.	SEED	529 LBS	535 LBS	+ 126.00
12.	FERTILIZER	1665 LBS	1617.5 LBS	- 14.25
14.	VEGETATIVE STRAW MULCH	40,500 LBS	33,000 LBS	- 1,500.00
15.	FARM FENCE - F3W	1750 LF	130 LF	- 2,430.00
16.	SINGLE PANEL	8 EACH	3 EACH	- 500.00
17.	DOUBLE PANEL	3 EACH	0 EACH	- 600.00
		SUB-TOTAL		+$103,444.88

Change Order No. 4
SHADWELL CREEK

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	ACTUAL QUANTITY	CHANGE IN PRICE
Change Order No. 1				
A.	SHAPE TOPSOIL STOCK-PILES FOR MULCH - CAT D-7 DOZER	20 HRS	19.5 HRS	-$ 39.00
B.	MULCH TOPSOIL STOCK-PILES W/4000 LBS/ACRE	8000 LBS	6360 LBS	- 492.00
C.	MULCH OTHER DISTURBED AREAS W/3000 LBS/ACRE	6000 LBS	7410 LBS	+ 380.70
		SUB-TOTAL		-$ 150.30
		TOTAL CHANGE IN PRICE		+$103,294.58

APPENDIX B

SLIDE LOG

SHADWELL CREEK COAL FIRE
Preliminary Engineering Photos

1A.	3/20/85	Smoke from burning seam
2A.	3/20/85	East bank - looking down river
3A.	3/20/85	East bank - looking down river
4A.	3/20/85	Coal burning on surface of east bank
5A.	3/20/85	Fissures caused by coal fire
6A.	3/20/85	Fissures caused by coal fire
7A.	3/20/85	Collapsing bank - looking downstream
8A.	3/20/85	Collapsing bank - looking downstream
9A.	3/20/85	Collapsing bank from top - looking up river
10A.	3/20/85	Collapsing bank from top - farther down
11A.	3/20/85	Collapsing bank from top - farther down
12A.	3/20/85	Bank cracking - starting to slough
13A.	3/20/85	Dead cattle in fissures - looking down river
14A.	3/20/85	Collapsing bank - looking upstream
15A.	3/20/85	Collapsing bank - looking upstream
16A.	3/20/85	Close-up of previous 2 pictures

17A.	3/20/85	Close-up of previous 2 pictures - taken from below
18A.	3/20/85	Sloughed bank at river level
19A.	3/20/85	Sloughed bank at river level looking upstream
20A.	3/20/85	Earth ramp on east bank
21A.	4/10/85	Boyce Drilling at BH #8
22A.	4/10/85	Pad for BH #9 - tractor on pad for BH #10
23A.	4/10/85	6" steel casing at BH #8
24A.	4/10/85	Drilling BH #10
25A.	4/10/85	Taken from river level at BH #10
26A.	4/11/85	Looking north at BH #11
27A.	4/12/85	Casing hammer on BH #17
28A.	4/12/85	Casing hammer on BH #20
29A.	4/12/85	Taken from river level
30A.	9/85	Preparing for water jetting
31A.	9/85	Preparing for water jetting
32A.	9/85	Dave Summers and water jet equipment
33A.	9/85	Water jet equipment
34A.	9/85	Water jet equipment
35A.	9/85	Water jet equipment
36A.	9/85	Water jet equipment
1B.	3/25/86	Vent hole from burning coal - note smoke
2B.	3/25/86	Vent hole from burning coal - note smoke
3B.	3/25/86	Vent hole from burning coal - note smoke
4B.	3/25/86	Close-up of vent hole on collapsed bank
5B.	3/25/86	Collapsed bank above vent hole

6B.	3/25/86	Collapsed bank 6' to 8' caved off
7B.	3/25/86	BH #2 and collapsed 6' to 8' caved off
8B.	3/25/86	View of riverbank from south end looking downstream
9B.	3/25/86	3 vent holes (not visible) at south end of project
10B.	3/25/86	Caving bank about midway through project
11B.	3/25/86	Looking south at collapsed bank with overhanging fence
12B.	3/25/86	Sloughing off of high bank from river level
13B.	3/25/86	Yellowstone River bank
14B.	3/25/86	Cattle skeleton in fracture of sloughing bank
15B.	3/25/86	Sloughing area from high bank
16B.	3/25/86	Sloughing area by BH #8 and BH #10
17B.	3/25/86	Fissure in sloughing area by BH's #8, 9 and 10
18B.	3/25/86	Fissure in sloughing area by BH's #8, 9 and 10-camera tilted to show bank
19B.	3/25/86	Sloughing bank by BH #10
20B.	3/25/86	Looking upstream from highbank - overview
21B.	3/25/86	Smoking vent hole
22B.	3/25/86	Smoking vent hole - same as above
23B.	5/86	Aerial slide of sloughing bank and BH's
24B.	5/86	Aerial slide taken from the north end of the project and looking south

SHADWELL CREEK
Before Construction

1.	9/26/86	Station 20+00 looking upstream
2.	9/26/86	Station 20+00 looking downstream
3.	9/26/86	Station 13+00 looking downstream
4.	9/30/86	Station 12+50 looking downstream
5.	9/30/86	Steam from coal fire at Station 15+80
6.	9/30/86	Steam from coal fire at Station 15+80 from riverbank
7.	9/30/86	Steam from coal fire at Station 45+50
8.	9/30/86	Riverbank at Station 33+00
9.	9/30/86	Riverbank at Station 30+00 looking downstream
10.	9/30/86	Riverbank at Station 30+00 looking upstream
11.	9/30/86	Riverbank at Station 24+50 looking downstream
12.	9/30/86	Riverbank at Station 24+50 looking upstream
13.	9/30/86	Steam from coal fire at Station 26+00
14.	9/30/86	Riverbank at Station 21+50 looking downstream
15.	9/30/86	Riverbank at Station 21+50 looking upstream
16.	9/30/86	Panorama of first half of project from Control Point #1
17.	9/30/86	Top of hillside at Station 23+50 shows BH #10
18.	9/30/86	Steam from coal fire at Station 26+00 60' left and elevation 965'
19.	9/30/86	Steam from coal fire at Station 26+00 50' left and elevation 975'
20.	9/30/86	Top of hill at BH #14
21.	9/30/86	Top of hill at BH #17
22.	9/30/86	Old fence line and top of bank at Station 17+00

23.	9/30/86	Soil testing trailer and pickup
24.	9/30/86	Condition of waste area

CONSTRUCTION DURING FALL OF 1986

25.	10/1/86	Topsoil Pile #1
26.	10/1/86	Topsoil Pile #1
27.	10/1/86	Topsoil Pile #1
28.	10/1/86	Topsoil Pile #1
29.	10/1/86	Topsoil Pile #1
30.	10/3/86	Removal of topsoil from waste area
31.	10/3/86	East side of Topsoil Pile #1
32.	10/3/86	Removal of topsoil from waste area
33.	10/9/86	Riverbank sloughing into water at Station 15+50
34.	10/10/86	Aggregate hopper and conveyor belt
35.	10/10/86	P&H Backhoe - 1-1/4" bucket
36.	10/15/86	Removal of topsoil from borrow area
37.	10/15/86	Station 23+00 on borrow area
38.	10/15/86	Look at borrow area from Control Point #1
39.	10/15/86	Look at borrow area from Station 25+50
40.	10/15/86	Borrow area and Control Point #1
41.	10/15/86	Terex TS-18 loading topsoil
42.	10/15/86	Terex TS-18 with a load of topsoil
43.	10/15/86	Riverbank sloughing at Station 15+50
44.	10/15/86	Riverbank sloughing at Station 14+00
45.	10/15/86	Riverbank sloughing from Station 14+00
46.	10/15/86	Riverbank sloughing from Station 15+50

47.	10/15/86	Riverbank at Station 14+00
48.	10/15/86	Equipment parked in waste area
49.	10/15/86	Borrow area before borrow
50.	10/15/86	Slough at 15+00
51.	10/20/86	Screen plant
52.	10/20/86	Screen plant
53.	10/20/86	Top view of screen plant
54.	10/20/86	Aggregate pile
55.	10/20/86	D-7 Dozer filling hopper
56.	10/20/86	Conveyor belt with unscreened material
57.	10/20/86	Screened aggregate loading conveyor belt
58.	10/21/86	Sunrise
59.	10/22/86	Borrow area and screen plant
60.	10/22/86	Screen plant
61.	10/22/86	Screened soil cement material
62.	10/22/86	Base of soil cement stockpile
63.	10/28/86	Screen plant with backhoe moving oversize rocks
64.	10/28/86	Screen plant
65.	10/28/86	Backhoe moving oversize rock
66.	10/28/86	Borrow area
67.	10/28/86	Soil cement stockpile
68.	10/28/86	Screen plant
69.	10/28/86	Beginning of unclassified excavation at BH's #14 and #17
70.	10/28/86	Terex TS-18 operator, Earl Burnham
71.	10/28/86	Scraper at Station 30+00
72.	10/28/86	Soil cement stockpile

73.	10/28/86	Oversize rock stockpile
74.	10/28/86	Unclassified excavation at BH's #14 and #17
75.	10/28/86	Unclassified excavation at BH #13
76.	VOID	
77.	VOID	
78.	11/19/86	Station 20+00 looking upstream after snowfall
79.	11/19/86	Station 20+00 looking downstream
80.	11/19/86	Station 17+00 smoke from coal fire
81.	11/19/86	Station 14+00 smoke from coal fire
82.	11/19/86	Station 14+00 topsoil pile
83.	11/19/86	Station 23+00 looking upstream
84.	11/19/86	Station 23+00 looking at BH #10
85.	11/19/86	Station 27+00 hot area at Station 25+50
86.	11/19/86	Station 27+00 waste area and equipment
87.	11/19/86	Station 27+00 BH's #14, #17 and #20
88.	11/19/86	Station 20+00 looking upstream
89.	11/20/86	D-7 preparing Topsoil Pile #1 for mulch
90.	11/20/86	Mulching Topsoil Pile #1
91.	11/20/86	Mulching Topsoil Pile #1
92.	11/20/86	Mulching Topsoil Pile #1
93.	11/20/86	Tucking mulch Topsoil Pile #1
94.	11/21/86	Tucking equipment
95.	11/21/86	Station 29+00 hot spot by BH #14
96.	11/25/86	Station 25+50 soil cement borrow area
97.	11/25/86	Station 21+50 soil cement borrow area
98.	11/25/86	Station 21+00 looking upstream

99.	11/25/86	Station 25+50 borrow area
100.	11/25/86	Station 28+50 excavation
101.	11/25/86	Station 31+00 excavation at Bh #14
102.	11/25/86	Waste area mulch
103.	11/25/86	Mulch on Topsoil Pile #1

CONSTRUCTION DURING SPRING/SUMMER 1987

104.	4/21/87	Station 12+50 D-7 excavating for dike
105.	4/21/87	Station 12+50 D-7 building ramp
106.	4/21/87	Station 14+00 D-7 pushing fill
107.	4/21/87	P&H Backhoe
108.	4/21/87	Station 14+00 D-7 excavating slope at Station 17+00
109.	4/21/87	D-7 excavating
110.	4/21/87	D-7 excavating
111.	4/21/87	TS-18 scraper
112.	4/21/87	View of work from Station 21+00
113.	4/22/87	D-7 at Station 15+00
114.	4/22/87	D-7 at Station 15+00
115.	4/22/87	Both D-7's building dike
116.	4/22/87	Station 29+00 excavation by BH's #14, #17 and #18
117.	4/22/87	Excavation at BH #14
118.	4/22/87	Excavation at BH #13
119.	4/22/87	Waste area
120.	4/22/87	Mechanics truck
121.	4/22/87	CAT 21 scraper

122.	4/22/87	Fuel truck
123.	4/22/87	Topsoil Pile #2
124.	4/22/87	Foreman's 3/4-ton pickup
125.	4/22/87	Power plant trailer
126.	4/23/87	Station 21+00 D-7 in coal fire smoke
127.	4/23/87	Station 22+00 slough and smoke
128.	4/23/87	Station 20+50 D-7 and Ken Burnham in coal fire smoke
129.	4/23/87	Station 20+50 D-7 and Ken Burnham in coal fire smoke
130.	4/23/87	Station 29+00 excavation at BH's #14 and #17
131.	4/23/87	Station 32+00 excavation
132.	4/23/87	Station 27+00 excavation
133.	4/23/87	P&H Backhoe at BH #11
134.	4/23/87	P&H Backhoe At BH #11
135.	4/24/87	Water truck and cement feed truck
136.	4/24/86	Station 32+50 Bh #17 and #14 with 15' of cut remaining
137.	4/24/86	Station 2+00 both dozers on dike
138.	4/24/86	Station 12+50 to Station 18+50 dike just prior to final preparation
139.	4/27/87	Station 22+50 both dozers building dike
140.	4/27/87	Station 12+50 to Station 20+00 bottom of dike to grade 925'
141.	4/27/87	Station 13+50 completed dike
142.	4/27/87	Water level stake
143.	4/27/87	Station 12+50 top of dike
144.	4/27/87	Bomag roller
145.	4/27/87	Station 25+50 slide area

146.	4/27/87	Station 25+50 slide area
147.	4/27/87	Station 26+00 slide area
148.	4/28/87	Station 26+00 slide area
149.	4/28/87	Station 26+00 slide area
150.	4/28/87	Station 26+50 slide area
151.	4/28/87	Station 26+00 D-7 building dike
152.	4/28/87	Station 23+00 looking upstream
153.	5/1/87	P&H Backhoe excavating bottom of soil cement
154.	5/1/87	Station 16+50 looking upstream at beginning of dike
155.	5/1/87	Water level top of stake at elevation 930.5
156.	5/1/87	Water level top of stake at elevation 930.5
157.	5/1/87	Station 13+00 dike and water in subgrade
158.	5/1/87	Station 12+50 key way
159.	5/1/87	Station 22+50 P&H Backhoe at Station 20+00
160.	5/4/87	Station 22+50 P&H Backhoe at Station 20+00
161.	5/4/87	Station 22+50 dike area
162.	5/4/87	Station 24+00 smoke on backslope
163.	5/4/87	Station 24+00 backslope
164.	5/4/87	Station 25+00 backslope approximate top of soil cement
165.	5/4/87	Station 27+00 backslope approximate top of soil cement
166.	5/4/87	Station 32+00 approximate top of soil cement
167.	5/4/87	Station 25+50 smoke from coal fire
168.	5/4/87	Equipment
169.	5/4/87	Batch plant

170.	5/4/87	Batch plant
171.	5/4/87	Station 27+00 looking upstream
172.	5/4/87	Station 27+00 looking upstream
173.	5/4/87	D-7 and Jersey spreader
174.	5/4/87	D-7 and Jersey spreader
175.	5/4/87	Station 23+00 P&H Backhoe excavating bottom of soil cement
176.	5/4/87	Station 23+00 upstream view
177.	5/4/87	Bomag roller and grader
178.	5/4/87	Bomag roller
179.	5/4/87	Conveyor and hopper
180.	5/4/87	Power plant, trammel and conveyors
181.	5/5/87	Water truck and power plant
182.	5/5/87	D-7 at Station 20+50 on haul road
183.	5/5/87	P&H excavating subgrade
184.	5/5/87	P&H excavating water settling area
185.	5/5/87	P&H excavating water settling area
186.	5/5/87	Paul Burnham studying conveyor belt scale manual
187.	5/5/87	Station 19+00 haul road
188.	5/5/87	Installing drain pipe for settling area
189.	5/5/87	John Deere 310 Backhoe
190.	5/5/87	Haul road and prepared subgrade
191.	5/5/87	Slide area at Station 20+00
192.	5/5/87	Slide area at Station 20+00
193.	5/5/87	Station 21+00 looking upstream
194.	5/5/87	Station 12+50 pumping water from subgrade
195.	5/7/86	Station 24+00 water settling area

196.	5/7/87	Station 21+00 slide area
197.	5/7/87	Station 21+00 slide area
198.	5/7/87	Station 12+50 looking downstream at prepared subgrade
199.	5/8/87	Slide area
200.	5/8/87	Station 19+00 looking upstream at prepared subgrade
201.	5/8/87	Station 18+00 prepared subgrade
202.	5/8/87	Station 22+00 rolling and watering soil cement
203.	5/8/87	Station 22+00 rolling and watering soil cement
204.	5/8/87	Batch plant
205.	5/8/87	Batch plant
206.	5/8/87	Batch plant
207.	5/8/87	Cement and aggregate conveyor belt
208.	5/8/87	Cement and aggregate conveyor belt
209.	5/8/87	Trammel and power plant
210.	5/8/87	Cement and aggregate scale meters
211.	5/8/87	Station 20+00 subgrade
212.	5/8/87	Station 20+00 JD-310 Backhoe spreading soil cement
213.	5/12/87	Batch plant
214.	5/8/87	Station 14+00 Jersey spreader waiting for truck
215.	5/15/87	Station 16+00 soil cement
216.	5/15/87	Station 16+00 Jersey spreader spreading soil cement
217.	5/15/87	Bomag roller and backhoe
218.	5/17/87	Batch plant rained out
219.	5/17/87	Station 13+00 soil cement rained out

220.	5/17/87	Station 18+00 soil cement rained out
221.	5/17/87	Station 18+00 rained out
222.	5/19/87	Jersey spreader
223.	5/20/87	Station 13+50 soil cement
224.	5/20/87	Station 15+00 backhoe and roller on soil cement
225.	5/28/87	Soil cement after rain at elevation 937.0
226.	5/28/87	Station 13+00 soil cement after rain
227.	5/28/87	Station 18+00 soil cement after rain
228.	5/28/87	Station 20+50 soil cement after rain
229.	5/28/87	Station 22+00 dike and subgrade
230.	5/28/87	Station 25+00 dike and subgrade
231.	5/28/87	Station 25+00 dike and subgrade
232.	5/29/87	Station 12+50 dike and soil cement
233.	5/29/87	Station 20+00 soil cement
234.	5/29/87	Station 22+50 subgrade
235.	5/29/87	Station 22+50 subgrade
236.	5/29/87	Station 24+00 subgrade
237.	5/29/87	Station 22+50 dike
238.	5/31/87	Station 12+50 water level top of stake equals elevation 930.5
239.	5/31/87	Station 12+50 dike saturated with water
240.	5/31/87	Station 20+00 looking upstream - water completely covers Phase I area
241.	5/31/87	Station 20+00 soil cement and trucks on haul road
242.	5/31/87	Station 24+50 trucks on soil cement
243.	5/31/87	Station 25+00 soil cement to elevation 930±
244.	5/31/87	Station 26+00 first lift of soil cement

245.	5/31/87	Station 28+00 first lift of soil cement
246.	5/31/87	Ed Larson
247.	6/1/87	Station 32+00 Bomag roller on soil cement
248.	6/1/87	Station 28+00 Ed Larson, Honda 4x4 and nuclear densometer
249.	6/1/87	Inside of trammel
250.	6/1/87	Station 14+00 roller off the compacted backfill
251.	6/8/87	Station 17+00 beginning removal of Phase II dike
252.	6/8/87	Station 28+50 soil cement at elevation 932.7
253.	6/8/87	Station 28+50 soil cement at elevation 932.7
254.	6/8/87	JD Backhoe removing dike
255.	6/8/87	Level of water inside the dike
256.	6/9/87	Station 14+50 compacted backfill on 943.0 lift
257.	6/9/87	Station 12+50 compacted backfill on 943.0 lift
258.	6/10/87	Station 24+00 looking upstream at dike removal
259.	6/10/87	Station 28+00 looking downstream at dike removal
260.	6/10/87	Station 29+00 dike removal
261.	6/10/87	Station 29+00 JD Backhoe
262.	6/10/87	Station 30+00 JD 310 Backhoe and 960 Loader
263.	6/10/87	Station 12+50 high water
264.	6/10/87	Station 20+00 beginning of soil cement ramp
265.	6/10/87	Station 22+00 ramp
266.	6/10/87	Station 30+00 top of soil cement
267.	6/10/87	Station 30+00 water truck
268.	6/10/87	Preparing existing soil cement by washing surface
269.	6/10/87	Station 25+50 soil cement joint

270.	6/16/87	Station 19+50 JD 310 Backhoe removing joint
271.	6/17/87	Station 20+50 smoke venting from crack
272.	6/17/87	Station 20+50 smoke venting from crack
273.	6/17/87	Station 24+00 loose unconsolidated material from borrow area
274.	6/17/87	Station 24+00 Jersey spreader
275.	6/22/87	Station 25+00 prepared soil cement
276.	6/22/87	Piece of soil cement removed from joint at Station 19+50
277.	6/22/87	Station 20+00 beginning of ramp
278.	6/22/87	Station 20+00 top of soil cement
279.	6/22/87	Station 15+00 downstream view
280.	6/22/87	Station 26+00 Jersey spreader spreading soil cement
281.	6/22/87	Station 26+00 Jersey spreader, JD 310 backhoe and Bomag roller
282.	6/22/87	Station 26+00 Jersey spreader, JD 310 backhoe and Bomag roller
283.	6/22/87	Station 28+00 setting final grades
284.	6/22/87	Final grade
285.	6/22/87	Station 21+50 irrigation pump pad ramp
286.	6/22/87	Placing final lift
287.	6/23/87	Batch plant
288.	6/23/87	Cement auger
289.	6/23/87	Geroge Burnham
290.	6/23/87	Irrigation pump pad
291.	6/24/87	Batch plant
292.	6/24/87	Remaining soil cement aggregate pile
293.	6/24/87	Irrigation pump pad

294.	6/24/87	Station 26+00 top of soil cement
295.	6/24/87	Station 26+00 top of soil cement
296.	6/24/87	Station 30+00 top of soil cement
297.	6/24/87	Station 30+00 top of soil cement
298.	6/24/87	Station 33+00 dike material
299.	6/29/87	Station 17+00 fill material
300.	6/29/87	Station 32+00 watering fill
301.	6/29/87	Station 28+50 compacted fill
302.	6/29/87	Station 24+00 CAT 21 scraper and Bomag roller
303.	6/29/87	Station 24+00 CAT 21 scraper dumping
304.	6/29/87	Station 20+00 grader
305.	6/29/87	Station 16+00 storm clouds
306.	6/29/87	Nuclear densometer equipment
307.	6/30/87	Station 19+00 building ramp
308.	6/30/87	Station 17+00 building ramp
309.	7/1/87	Balducki's water pump
310.	7/1/87	Balducki's water pump
311.	7/1/87	Balducki's water pump
312.	7/6/87	D-7 dozer loading CAT 21 scraper
313.	7/6/87	Borrow area and D-7 on excavation
314.	7/6/87	Station 25+00 D-7 and TS-18 scraper
315.	7/7/87	CAT 21 scraper broke down
316.	7/8/87	Access road hole beginning of fill
317.	7/8/87	D-7 CAT preparing access road hole
318.	7/8/87	CAT 21 scraper dumping in access road hole
319.	7/8/87	D-7 CAT pushing CAT 21 scraper

320.	7/14/87	Finished access road hole looking east
321.	7/14/87	East side of access road hole
322.	7/14/87	West side of access road hole
323.	7/14/87	Access road hole looking west
324.	7/14/87	Station 12+50 soil cement and compacted backfill
325.	7/14/87	Station 17+00 location of fenceline
326.	7/14/87	Station 18+00 irrigation pump pad ramp
327.	7/14/87	Pickup on pump pad at elevation 935
328.	7/14/87	Station 22+75 hairline crack in soil cement
329.	7/14/87	Station 29+00 water truck on fill
330.	7/14/87	Station 29+00 CAT 21 scraper and both D-7 dozers
331.	7/14/87	Station 21+50 compacted backfill
332.	7/14/87	Station 24+50 compacted backfill
333.	7/14/87	Station 25+00 compacted backfill
334.	7/14/87	Station 25+00 Bomag roller on fill
335.	7/14/87	Panorama from hill south of project
336.	7/14/87	Panorama of equipment storage area and access road fill
337.	7/16/87	Station 24+50 removing casing from BH #10
338.	7/16/87	Station 24+50 removing casing from BH #10
339.	7/16/87	Station 24+50 removing casing from BH #10
340.	7/16/87	Station 27+50 removing casing from BH #13

CONSTRUCTION DURING FALL OF 1987

341.	10/28/87	Station 25+00 topsoil
342.	10/28/87	Both D-7 dozers spreading topsoil

343.	10/28/87	Both D-7 dozers spreading topsoil
344.	10/28/87	Both D-7 dozers spreading topsoil
345.	10/28/87	D-7 dozer spreading topsoil
346.	10/28/87	D-7 dozer spreading topsoil
347.	10/28/87	Station 17+00 looking downstream
348.	10/28/87	Station 17+00 looking downstream
349.	10/28/87	Ramp area
350.	10/28/87	Both D-7 dozers spreading topsoil
351.	10/28/87	Topsoil waste area
352.	10/28/87	Topsoil waste area
353.	10/29/87	Station 30+00 finished slopes with topsoil
354.	10/29/87	Tracking of topsoil
355.	10/29/87	Topsoil area
356.	10/29/87	Ramp area after topsoil
357.	10/29/87	Top of Lelands' property after topsoil
358.	11/3/87	Truck with load of 12" PVC
359.	11/3/87	Truck with load of 12" PVC
360.	11/3/87	Numbers on the side of the 12" PVC
361.	11/4/87	Compression coupler and end of 12" PVC
362.	11/4/87	View of project from upstream end
363.	11/4/87	JD 310 backhoe digging trench for steel pipe
364.	11/4/87	JD 310 backhoe installing steel pipe
365.	11/4/87	Install first length of 12" PVC
366.	11/4/87	Compression coupler
367.	11/4/87	JD 310 backhoe digging trench
368.	11/4/87	12" PVC at the top of access road

369.	11/4/87	12" PVC trench from top of ramp
370.	11/4/87	12" PVC trench from bottom of ramp
371.	11/5/87	Hydroseeding
372.	11/5/87	Hydroseeding
373.	11/5/87	Hydroseeding
374.	11/5/87	Completed slope after hydroseeding
375.	11/5/87	Hydroseeding
376.	11/5/87	Hydroseeding
377.	11/5/87	Placing gravel on irrigation ramp
378.	11/5/87	Hydroseeding and D-7 dozer on ramp
379.	11/5/87	Hydroseeding and fencing
380.	11/9/87	Harrow on Lelands' property
381.	11/9/87	Harrow on Lelands' property
382.	11/9/87	Seed drill
383.	11/9/87	Fertilizer equipment
384.	11/9/87	Fertilizer equipment
385.	11/9/87	Fertilizer equipment
386.	11/9/87	Fertilizer equipment
387.	11/9/87	Seeding Lelands'
388.	11/9/87	Seeding Lelands'
389.	11/9/87	Seeding Lelands'
390.	11/9/87	Mulching equipment
391.	11/9/87	Mulching equipment
392.	11/10/87	Spreading mulch in waste area
393.	11/10/87	Spreading mulch in waste area
394.	11/10/87	Spreading mulch in waste area

395.	11/10/87	Spreading mulch in waste area
396.	11/11/87	Irrigation ramp and gabion baskets
397.	11/11/87	Irrigation ramp and gabion baskets
398.	11/11/87	JD 310 backhoe and workers installing gabion baskets
399.	11/11/87	JD 310 backhoe and workers installing gabion baskets
400.	11/11/87	JD 310 backhoe and workers installing gabion baskets
401.	11/16/87	JD 310 backhoe and D-7 with workers installing gabion baskets
402.	11/16/87	JD 310 backhoe and D-7 with workers installing gabion baskets
403.	11/17/87	Partially completed gabion baskets
404.	11/17/87	Partially completed gabion baskets
405.	11/18/87	Gabion baskets and workers
406.	11/18/87	Gabion baskets prior to rock fill
407.	11/18/87	JD 310 backhoe shaping ground around gabion baskets
408.	11/18/87	JD 310 backhoe shaping ground around gabion baskets
409.	11/18/87	JD 310 backhoe shaping ground around gabion baskets
410.	11/18/87	JD 310 backhoe shaping ground around gabion baskets
411.	11/19/87	Concrete truck ready to pour pump pad
412.	11/19/87	Backing concrete truck to first pour
413.	11/19/87	Pouring concrete
414.	11/19/87	Leveling concrete
415.	11/19/87	Finishing concrete
416.	11/19/87	Finishing concrete

417.	11/19/87	Finishing concrete
418.	11/19/87	Finishing concrete
419.	11/19/87	Finishing concrete
420.	11/19/87	Roller bug used to roughen concrete surface
421.	11/19/87	Placing concrete
422.	11/19/87	Placing concrete
423.	11/19/87	Placing concrete
424.	11/19/87	Finished surface of concrete
425.	11/19/87	Finished concrete pump pad
426.	11/19/87	Workers after finishing pour
427.	11/19/87	View of irrigation pump pad from access road
428.	11/19/87	View of irrigation pump pad from access road
429.	11/19/87	Welding connection to irrigation pipe
430.	11/19/87	Welding connection to irrigation pipe
431.	11/19/87	Completed irrigation pump pad and access ramp
432.	11/19/87	Welding connection to irrigation pipe
433.	11/19/87	Signature in concrete
434.	11/19/87	Completed pad looking upstream
435.	11/19/87	Welding above completed pad
436.	11/19/87	Completed pad from shore level
437.	11/19/87	Completed pad from shore level
438.	11/19/87	Completed pad from shore level
439.	11/19/87	Placing straw on completed pump pad
440.	11/11/87	Balducki's alfalfa field
441.	11/11/87	Fabricating gabion baskets before installation
442.	11/11/87	JD 310 backhoe excavating trench for gabions

443.	11/11/87	JD 310 backhoe excavating trench for gabions
444.	11/11/87	Ken Burnham and Charley Spoonmoor installing gabion basket
445.	11/11/87	Gabion basket
446.	11/11/87	JD 310 placing fill in gabion basket
447.	11/11/87	JD 310 placing fill in gabion basket
448.	11/11/87	Wiring gabion baskets together
449.	11/11/87	Completed gabion basket
450.	11/11/87	Excavated trench ready for gabion basket
451.	11/12/87	JD 310 excavating for gabions
452.	11/12/87	Portion of the gabions installed

APPENDIX C

ANALYSIS OF PROFESSIONAL SERVICE FEES
DATE OF PREPARATION: February 3, 1988
PROJECT: Shadwell Creek Fire Project

PROFESSIONAL SERVICE	AMOUNT
* Data Gathering, Site Evaluation, Preliminary Engineering, Final Engineering, Bidding Documents	$42,092.26
* Construction Administration, Construction Inspection, Final Report Preparation	$85,897.15
L.C. HANSON CO. COSTS	$127,989.41
CONSTRUCTION COSTS	$554,772.51

PERCENTAGE ANALYSIS

PRE-CONST. LCH CO COST/CONSTRUCTION COST	7.59%
CONST. & POST CONST. LCH CO. COST/CONSTRUCTION COST	15.48%
TOTAL LCH CO. COST/CONSTRUCTION COST	23.07%

REMARKS: Services provided include lien determination, landowner consent, budget preparation, grant application, weed board approval, basic engineering, construction staking, contract administration, quantity accounting and full time resident inspection. This project involved extensive exploratory drilling, setting of temperature probes, monitoring of temperature and reporting of data. The design called for application of past methods to a new application. Construction took place over portions of two construction seasons and complete quality control testing was performed during construction.